

# Alaskan Transportation

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## IN THIS ISSUE...

Hydraulic Dump Gate

## DOT&PF Research:

- Magnetic Guidance for Snowplows
- Verification of Roughness Coefficient
- Pavement Marking Performance

## FHWA Research:

- Performance of Retroreflectometers
- Sealing and Filling Cracks in Asphalt

TRIS Online

CERF and HITEC Activities

## PLUS...

Safety & Health Issues

Go Metric!

## Local Technical Assistance Program

### Hydraulic Dump Gate

Hydraulic Lift Tailgate for Dump Trucks: Sharing Technology Between Countries

Most people know a good idea when they see one, especially if it makes their work safer and more efficient. That's what happened when some of the Yukon Government Transportation and Community Services (YGT) employees visited Fairbanks. They participated in an Alaska Department of Transportation and Public Facilities' (DOT&PF) Maintenance Foreman's meeting in the fall of 1998, courtesy of Alaska's federally funded Border Technology Exchange Program. Toby

continued on page 2



### Magnetic North? Try Magnets in the Road

#### Introduction

Intelligent Transportation Systems (ITS) are changing the way that highway agencies provide good, safe roads for the travelling public. ITS also affects how maintenance workers go about their jobs; in this case, snowplow operators are the ones interested in what ITS has to offer.

One of the new ITS products is a magnetic guidance system (MGS)

for vehicles. Alaska Department of Transportation and Public Facilities (DOT&PF) is installing such a system in a road rehabilitation project in the Richardson Highway's Thompson Pass area, near Valdez. The envisioned system won't guide passenger cars or commercial trucks; rather, it guides snowplows along the road.

continued on page 6

## Hydraulic Dump Gate *continued from page 1*

Davignon from Whitehorse showcased a hydraulic system that he and others at his agency developed to lift the tailgate on dump trucks. Their goal was to streamline chipping operations. And the Alaskans quickly picked up on the idea. They built one with a few modifications, used it all of 1999, and it worked so well that they're adapting a second truck box with the hydraulic lift.

For chipping operations, dump boxes are usually retrofitted with a box-wide, foot-long lip, which is bolted on. When chipping operations are over, this addition has to be removed before any other work can happen. While the lip keeps chips or D1 from escaping from the box while they are being dumped into the chipper hopper, it also gets in the way during the dumping process if there's material already piled in the box.

Typically, chips build up at the back of the chipper's hopper, due to the flat-bottom design of the receiving hopper. A swing-type tailgate can hang up on the built-up material, which then keeps the tailgate from opening fully. Especially troublesome is the resulting safety issue: a person has to get into the hopper on the chipper to shovel the built-up material out of the way.

YGT wanted to make their chipping operations safer and easier, so they retrofitted the box of a T500 Kenworth, moving it back on the truck to accommodate the chipper, and installed a hydraulic lift. The lift

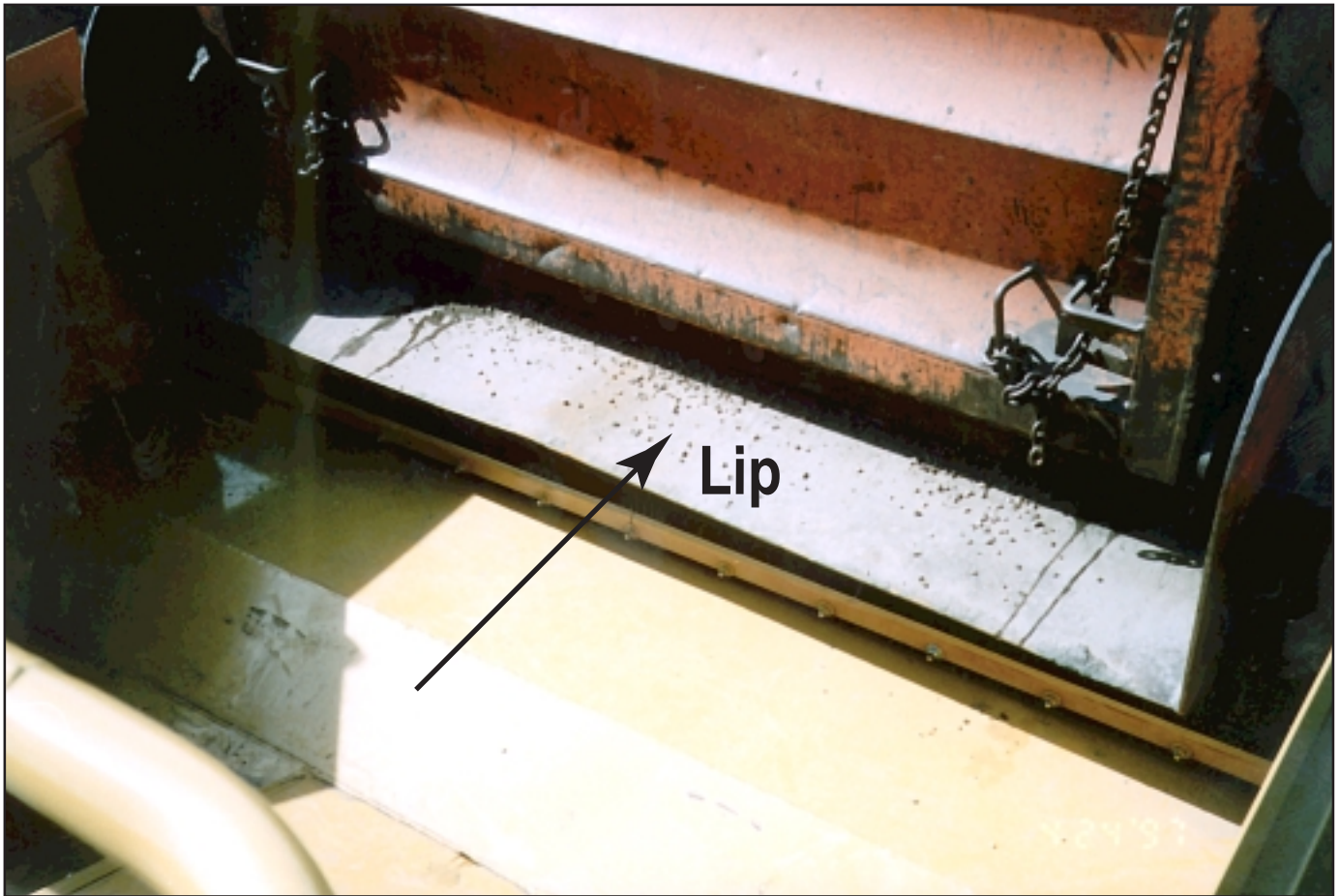


*The lift makes the tailgate go straight up, rather than allowing it to swing open. Inset is a view of a Canadian truck during conversion, showing the position of the ram (similar to Alaska DOT&PF truck).*

makes the tailgate go straight up, rather than allowing it to swing open. To keep from limiting the truck's all-around capability, the Canadians kept the ability for the tailgate to swing open.

Alaska DOT&PF's Northern Region Maintenance and Operations (M&O) used an eight-yard Freightliner, a different truck than YGT. Due to truck weight distribution considerations, the Alaskans, led by Mike Albright and Steve Potter, extended the length of the dump box by one foot, then installed the

hydraulic gate. The extension served the same purpose as the YGT technique of moving the box back to accommodate the chipper. Alaska also retained the swing-open capability. A note of warning: if you extend the dump box, you do have to incorporate the power tailgate, because the extended box goes farther into the chipper. With a lip extension, the tailgate remains in the same place relative to the truck placement when hooked up to the chipper. With the extended dump box, the gate is farther out over the



*Dump boxes are usually retrofitted with a box-wide, foot-long lip. The hydraulic, or power lift, system allows the tailgate to raise straight up. Chips drop directly into the chipper hopper, very little material spills on the way into the hopper, and a human body doesn't have to jump into the hopper quite as often.*

chipper, making it swing a foot deeper into the chipper, so you do need to have the vertical power gate. Extending the box and failing to install the power lift gate defeats your purpose.

The hydraulic, or power lift, system allows the tailgate to raise straight up. Chips drop directly into the chipper hopper, very little material spills on the way into the hopper, and a human body doesn't have to jump into the hopper quite as often to shovel away the piled-up material. This system allows the tailgate to go straight up when chipper operations are the mode of the day, and it keeps the ability to swing when the shift to other operations occurs. The operator doesn't have

to change out the lip every time the work mode changes. He or she simply reaches for a different lever on the hydraulic module (console) in the cab: one lever for the hydraulic lift while chipping; a different switch for swinging the tailgate open for any other work, such as hauling rock or asphalt. On the dump box, in a spot visible through the side mirror, the workers added an indicator so the driver can meter the material out if the need arises.

In Alaska, Northern Region M&O used the contraption all last summer. Benefits the crews noticed include:



*The new valving for the hydraulic dump gate installed under the bed.*

- the operator can control the lift gate in increments so it's open a little, a lot, or not at all, which made the chipping operation more efficient;
- over the course of a season, lip repair and cleaning disappeared, a cost and time savings;
- there was a time-savings by avoiding the installation and removal of the lip every time the truck moves from one type of job to another; and
- it can haul just about an extra cubic yard of material due to the larger dump box.

According to Foreman Mike Blanning, the greatest hurdle turned out to be retraining old habits—truck drivers had to get accustomed to using a different function inside the cab during chipping operations. Instead of backing up, hooking up and popping the switch for the tailgate release, drivers had to remember to reach for the lever to raise the gate.

Cost isn't that great, compared to safer operations and better use of time. Building and installing the lift gate is a two-part expense: the box extension is about \$2,500 and the cost of pieces and parts run about \$2,000. Both YGT and Alaska DOT&PF used mostly their own workforces to do the retrofitting. In Alaska, the dump box retrofit was taken to a local fabrication shop. Specifications and parts lists can be obtained by calling the contacts listed below.

*Contacts: Toby Davignon: 867-667-5644, Yukon Government Transportation and Community Services, Mechanical Services, Whitehorse; Mike Albright and Steve Potter: 907-451-2205 Alaska DOT&PF, Northern Region Maintenance and Operations.*



*The operator doesn't have to change out the lip every time the work mode changes. He or she simply reaches for a different lever on the hydraulic module (console) in the cab.*



*On the dump box, in a spot visible through the side mirror, the workers added an indicator, so the driver can meter the material out if the need arises.*

A 2:45 minute video of the YGT hydraulic lift gate in operation can be borrowed from the Alaska T2 Center. Call 451-5320.

# Magnetic Path

*continued from page 1*

## PATH Magnetic Guidance System

California's highway agency, CalTrans, together with a consortium of public agencies, universities, and private companies called Partners for Advanced Transit and Highway (PATH), tried the MGS on Interstate 80 near Donner Summit. Their magnetic system was installed on an existing road; they drilled holes, dropped the magnets in, and epoxied them in place. Alaska's will be installed during a rehabilitation project, so the process will be different and hasn't been tried anywhere else. The magnetic markers will be installed, most likely by drilling or punching holes, in the rotomilled asphalt-treated base, then paved over with asphalt. Also, rather than being on the centerline as PATH's are (see below) the markers will be offset from the guardrail, and in truck lane areas, offset from the centerline as well.

## How PATH's MGS Works

The MGS is a series of magnetic markers that serve as a roadway reference, plus vehicle-borne sensing and processing units that obtain information from the markers. Simple permanent magnets embedded in the center of a lane, about 1.2 meters apart, indicate the lane center. Alternating the magnetic polarities of the markers (north-up vs. south-up) creates a binary code that indicates roadway characteristics. One binary-coded message about roadway characteristics requires an average of 25 markers, which takes up 30 meters of roadway. The elapsed time to read that message would be about a second for a vehicle traveling at 100 km/h (60 mph or 88 feet per second).

Fluxgate magnetic sensors, mounted under the front and rear bumpers of a vehicle, measure the magnetic fields on three axes. A Pentium computer in the trunk processes the magnetic field data to derive lateral and longitudinal position measurements and to decode the binary information. (The computer also performs all other vehicle control functions.)

## Snowplow Drivers Will Benefit

Today, snowplow operators, with the very limited visibility caused by winter conditions, often don't know their exact location in the roadway prism. They have to drive at speeds great enough to effectively

remove snow, while remaining alert for roadside obstacles and obstructions. Low visibility and the absence of distinct cues that delineate the road decrease the snowplow speed and efficiency.

Consequently, they use the guardrail as guidance by riding with the snowplow blade, which is wider than the truck pushing it, snugged up against the guardrail. The result is that clearing the snow from the roadway takes more time. Unfortunately, that practice wreaks expensive havoc on the guardrail. To stay in compliance with safety guidelines, Maintenance and Operations forces have to replace a lot of guardrail each summer, only to ruin it again over the course of the winter.

The magnetic guidance system is intended to help the operator stay on track, avoid the guardrail, and not veer into the oncoming traffic lanes. The guidance system should prove very handy during winter conditions when the road is obliterated completely. A console in the truck will indicate where the operator is in relation to the guardrail and the remainder of the road. Magnets installed on the blade and on the underside of the truck will correlate with magnets installed in the asphalt. The resulting guidance appears on a computer in a console inside the cab of the truck.



*Sealing magnets with epoxy. Photo courtesy of PATH.*



*Pressing in magnets. Photo courtesy of PATH.*

## Goal for Alaska's Magnetic Guidance System Experimental Project

The guidance system is part of a regular construction rehabilitation project and will be handled as an experimental feature, under separate funding. The experimental feature aspect means that construction funds aren't impacted, and there is a mechanism for monitoring the success for several years after construction is finished. The project will help Alaska DOT&PF identify and analyze potential benefits to the department, its maintenance budget, its snowplow operators, and the travelling public before going forward with more projects in other areas of the state.

*For more information, call the following at Alaska DOT&PF's Northern Region: Maintenance and Operations Director Ralph Swarthout, 907-451-2295; Southcentral M&O District Manager George Levasseur, 907-834-1039; or Research Engineer Jim Bennett, 907-451-5322. To learn more about PATH, go to <http://www.path.berkeley.edu/PATH/Research/magnets/> or contact Wei-Bin Zhang, University of California at Berkeley, 510-231-9538 or Mike Jenkinson, CalTrans, 916-657-3867.*



A video about PATH can be borrowed from the Alaska T2 Center. Call 451-5320.

## Announcing the Pacific Northwest Snowfighters Conference

The Pacific Northwest Snowfighters Conference will be held June 12, 13, and 14, 2000 at the Grand Okanagan Resort and Conference Centre in Kelowna, British Columbia, Canada.

The event will focus on current technologies and issues that affect winter maintenance professionals in North America.

The Pacific Northwest Snowfighter's web site is now active. It covers the materials specifications and research from British Columbia, Idaho, Montana, Oregon, and Washington. The web site is <http://www.wsdot.wa.gov/fossc/maint/pns/>

*"Improving Alaska's quality of transportation through technology application, training, and information exchange."*



## The First Annual Cold Weather Show

The Cold Weather Show to be held on August 8–9, 2000, at the Hyatt Regency Crystal City, Arlington, Virginia, is the first in a series of annual exhibitions and conferences that will focus on providing and maintaining essential services under cold weather conditions.

This world class conference program will feature papers from military, government, and academic institutions, manufacturers, and designers.

The Cold Weather Show and Conference will alternate annually between the USA and Europe, representing national and international expertise across a range of cold weather equipment and issues.

The U.S. Army, Soldier Systems Command at Natick (SSCOM and NRDES) will support the Cold Weather Show with conference presentations and an exhibit of their cold weather programs and capabilities.

The Cold Weather Show DC 2000 is strategically sited in Crystal City, adjacent to the Pentagon and other main DoD centers, close to the national and federal agencies located in Washington, D.C., and minutes from Washington National Airport.

For more information: [www.coldweather.com](http://www.coldweather.com)  
e-mail: [info@coldweather.com](mailto:info@coldweather.com)



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## Green Bay 2000: American Indian Tourism Conference

The second annual conference promises to be a memorable experience in Native American tourism. A once dormant giant in the tourism industry, Tribes across the country are taking steps towards developing tourism initiatives on or near their reservations.

Workshops cover a variety of topics, from developing you own attractions, to partnering with a tribe. Learn how to maximize your tourism potential and capture the market that's right for your product or service.

The second Annual American Indian Tourism Conference will be held on September 28–30, 2000, in Green Bay, Wisconsin. The conference will be held at the Radisson Hotel and Conference Center, located directly across from Austin-Strubel Airport.

The following Green Bay Hotels have set aside room blocks with a special rate for the conference:

- The Radisson Hotel (Host Hotel) (920) 494-7300 (888) 333-3333 Nationwide

- Settle Inn (920) 499-1900
- Extended Stay (920) 499-3600 or (800) 521-4020

For a listing of other accommodations available in the Green Bay area, please call the Green Bay Visitor and Convention Bureau at 888-TO-SEE-GB (888-867-3342). You may also visit their web site at [www.greenbay.wi.com](http://www.greenbay.wi.com).

**For more information** regarding the conference, please call Gloria Cobb or Jerry Rayala at (715) 588-332. You may also visit the conference web site at [indiantourism.org](http://indiantourism.org) or check out the conference information at [www.glitc.org](http://www.glitc.org).

Other activities include Native American arts and crafts exhibits, golf outing and familiarization tour of the Oneida, Stockbridge and Menominee Reservations.



## Pacific Northwest Transportation Technology Expo 2000 Technology on Parade

Tired of just reading about it?! Would you like to get your hands on it, kick the tires, and watch it work?! Then, plan to attend the first technology exposition focused solely on presenting the latest technology in transportation maintenance and operations to the public agencies in the Pacific Northwest. The expo is cosponsored by the WSDOT-Field Operations Service Center, Washington State Technology Transfer Center, and FHWA to present you the most current technology targeting the areas identified by the Pacific Northwest agencies.

See first hand the innovative ideas to save money, improve performance, and reduce labor developed and implemented by your peers. Play with their inventions, see how they work, and get ideas on how you can use or improve on them. Talk with the inventors and learn how they made it so you can do it yourself.



See dozens of displays of the latest tools, materials, current research projects, and services to make your maintenance and operations dollars go farther.

When: September 12, 13, & 14, 2000

Where: Grant County Fairgrounds, Moses Lake, Washington

How Much: Free!

Who should attend: All engineers, superintendents, supervisors, and technicians involved with transportation construction, maintenance, and operations.



## Got a Better Mouse Trap? Come and Share it With the Rest of Us!

A major part of Expo 2000 (see above) will be set up for demonstrations and displays of practical tools, equipment modifications, and new techniques developed and used in the field by public agencies. No idea is too small. If it works and saves you time and money, we invite you to share it with the rest of the agencies in the Pacific Northwest. This will be one big three-day "show-and-tell" to share your ideas and see what others like you have done to be more efficient and effective.

Attendance, registration, and display space are free to public agencies. We have plenty of space. Just let us know what your innovation is and how much space you need. We'll make the arrangements to get you a site.

Please submit your ideas to either:  
Clay Wilcox, Maintenance Superintendent  
WSDOT-FOSSC  
PO Box 47358  
Olympia, WA 98504-7358  
(360) 705-7861  
wilcoxc@wsdot.wa.gov  
or  
Dan Sunde, WST2 Center  
WSDOT-H&LP  
PO Box 47390  
Olympia, WA 98504-7390  
(360) 705-7390  
sunded@wsdot.wa.gov



## TRIS Online Now Available on the National Transportation Library's Internet Site

On January 10, the U.S. Department of Transportation's Bureau of Transportation Statistics (BTS) and the Transportation Research Board (TRB) announced TRIS is now online on the National Transportation Library's (NTL) Internet site. The Transportation Research Information Service (TRIS), the world's largest and most comprehensive bibliographic database on transportation, was developed by TRB over the past 30 years with support from state and federal agencies. Web access to TRIS is a result of a Memorandum of Understanding (MOU) between BTS and TRB. The MOU provides for developing, testing, and implementing a fully searchable public-domain, web-based version of the TRIS database.

The TRIS database contains more than 500,000 records of published and ongoing research on all modes of transportation. TRIS Online will improve TRIS by allowing users to access electronic copies of full-text reports or to link directly to the publishers or suppliers that produce the documents. TRIS Online is

now a vital core component of the NTL being developed by BTS.

The NTL makes available major transportation materials from around the world, indexes transportation web pages, and will ultimately provide a national union catalog of the country's major public and private transportation library collections and statistical databases. The NTL staff now respond to approximately 25,000 e-mail and telephone inquiries annually.

TRB will continue produce TRIS. BTS will publish the database and make it available on the Internet as a component of the NTL, and will also provide the links to full-text reports and document publishers. Within three years, it is anticipated that over 70 percent of government reports listed in TRIS Online will be available electronically for downloading, printing, or through e-mail requests.

TRIS Online can be found at the Internet site <http://ntl.bts.gov/tris>. The NTL's site is <http://ntl.bts.gov/>.

More than 400,000 books, journal articles, and technical reports on transportation research from the 1960's to the present. [Details...](#)

### SEARCH TIPS

TRIS is searched for the phrase or search expression you provide.

**AND** requires both terms.

**OR** finds either term.

**NOT** excludes results containing that term

Wild cards — \* and ? — extend results.

Terms are not case sensitive

### Refining your search

Too few results?

Too many results?

### Beyond the basics

### Search For:

### Search In:

☒ Article Title☒ Abstract☒ Keyword☐ Organization☐ Contributors  
author, editor, discussor☐ Journal Title  
or Conference  
Title

### Search Period:

☐ Last 1 year☐ Last 5 years☐ Last 10 years☐ Last 20 years☒ ALL

## Searching TRIS Online

[Basics](#) [Refinements](#) [Strategies](#) [Syntax \(advanced\)](#)

### Basics:

Search terms are **not case sensitive**.

washington  
Washington  
WASHINGTON  
yield the same results

Use **several** search terms.

**national bridge inventory or NBI**

**AND** between terms narrows the search to results where both terms are found.

**safety and airbag**  
97 results  
**safety and air bag**  
82 results

**OR** between terms broadens the search by including results where either term is found.

**safety or airbag**  
1,992 results  
**safety or airbag or air bag**  
1,997 results

**NOT** before a term excludes results containing that term.

**highway noise**  
173 results  
**highway noise not barrier**  
114 results

**Phrasing** is assumed.

**noise prediction model**  
31 results

Use **quotes** for exact phrases.

**"noise prediction model"**  
27 results  
**"noise prediction models"**  
5 results  
(Be cautious with plural forms when using quotes.)

**Singular** form of the term will also find plural.

**pave** finds both  
pave and paves

Use **wild cards** — \* and ? — to extend results.

**pave\*** finds  
pave, paves, paver, pavement, Pavelich  
(any word beginning with **pave**)

Top

### Refining your search:

#### No results? Too few results?

**Cast your net wider** to increase your catch.

- Use single words separated by **OR** rather than a phrase
- Think of another word or phrase with similar meaning.
- Try using wild cards and singular forms to catch variations of your search terms.

**Use your first results** as a base to extend your search.

- Look for new search terms in these keywords & titles.
- Add these new search terms to your query

**Use alternative phrase or spelling.**

#### Too many results?

You can **zero in on your target** by refining your query.

- Use a specific phrase, rather than a series of terms.
- Use AND before each term you require.
- Use NOT to exclude terms irrelevant to your search.

**Limit the search period.**

#### Beyond the basics:

Use several search terms and group your terms using parentheses.

Use **acronyms** with caution. They change over time. They may not be listed in titles or among keywords.

**pave?** finds  
pave, paves, paver  
(substitutes for **one** character only)

**speed bump**  
29 results  
**speed bump or speed hump**  
53 results  
**speed bump or speed hump or speed control hump**  
61 results

**highway and noise model**  
13 results  
**highway and noise prediction model**  
23 results

**road kill** finds 8 results  
**roadkill** finds in 9 results  
**road kill or roadkill** finds 16 results

**fatigue and truck and accident**  
40 results  
**driver fatigue and truck and accident**  
17 results  
**driver fatigue and truck accident**  
6 results

**child\* and (airbag or air bag)**  
95 results  
54 results for last 5 years  
6 results for last 1 year

**speed bump**  
29 results  
**speed bump and neighborhood**  
5 results  
**(speed bump or speed hump or speed control hump) and neighborhood**  
10 results

**FHWA and noise prediction model**  
10 results  
**highway and noise prediction model**

Words and phrases also change, so this year's term may not find the same concept in an older article.

Use **new terms** found in initial queries to extend your search.

23 results  
(The detail record displays for 18 of these results refer explicitly to FHWA or Federal Highway Administration.)

**speed bump**  
25 results (1975-1995)  
**speed hump**  
32 results (1983-1999)

**highway and noise prediction model**  
23 results, some referring to "Standard Method in Noise Analysis" or "STAMINA"  
**Standard Method in Noise Analysis**  
finds only 1 result, but  
<CASE> <WORD> STAMINA  
(to search for word with upper or lower case as entered)  
finds 31 results

Note: Counts shown are for illustration only and result from searches made 12/99. These counts may change as TRIS Online evolves.

Top

### Strategy

Keying in that first keyword or phrase is the just the beginning of a search. Even experienced searchers need to refine their search terms to get usable results. Yet many searchers stop with their first set of results.

**A search for a specific citation, article title, or author** may yield complete results with the first try -- if the title quoted or the author referenced is precisely correct. No results? Then altering the search terms may help.

- Quote a key phrase from the title.
- Search for all works by the author or authors, separating names with a comma, or using last names only.

**A search for a topic or concept often requires a series of searches.**

**Example:** You are working on a legal case and need to find individuals or organizations with expertise in design of end terminals of guard rails.

So you begin with your first selection of keywords.

GUARD RAIL AND HIGHWAY AND  
END  
Only 2 results!

But you note, reading these results, that GUARD RAIL is spelled as one word, GUARDRAIL. So you revise your search terms accordingly.

GUARDRAIL AND HIGHWAY AND  
END  
25 results. That's better.

You could stop here, but you noticed that terminal is another term used for end. So you revise your search terms again.

GUARDRAIL AND HIGHWAY AND  
(END OR TERMINAL)  
32 results. Better yet.

Just to be thorough, you revise your search terms to include both spellings of guardrail.

(GUARDRAIL OR GUARD RAIL)  
AND HIGHWAY AND (END OR  
TERMINAL)  
34 results.

This is gratifying, but you were looking for individuals and organizations with current expertise. So you limit your search period.

Last 5 years  
(GUARDRAIL OR GUARD RAIL)  
AND HIGHWAY AND (END OR  
TERMINAL)  
9 results.

Now you can read through the abstracts from these results and decide which documents will provide information you need.

Note: Counts shown are for illustration only and result from searches made 12/99. These counts may change as TRIS Online evolves.

[Top](#)

### Advanced query syntax

For advanced query syntax read the [Verity Query Language](#) reference pages.

[Top of Page](#)

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[How BTS protects your privacy when you visit our website.](#)

## Performance of Six Retroreflectometers is Documented

*Washington, D.C., January 21, 2000*—In 1992, the United States Congress required that the highway industry set a standard level of retroreflectivity for pavement markings. Retroreflectivity is a measure of the nighttime visibility of a pavement marking, and it is important to have high levels of retroreflectivity so drivers can safely negotiate our highways. This requirement has created a large demand for retroreflectometers, devices that measure retroreflectivity. Consequently, the Federal Highway Administration (FHWA) funded an independent evaluation of pavement marking retroreflectometers through the Highway Innovative Technology Evaluation Center (HITEC), a service center of the Civil Engineering Research Foundation (CERF). The evaluation is now complete and HITEC has released six technical evaluation reports documenting the performance of six pavement marking retroreflectometers, including hand-held and mobile units (mounted on a van). The hand-held devices tested included the FRT0 1, LTL2000, Mirolux Plus 30, and the MX30 and the mobile units tested included the Ecodyn and the Laserlux. An 18-member panel of experts from government, industry, and academia planned and oversaw the entire evaluation project. During the evaluation, the retroreflectometers were used to measure the brightness and visibility of yellow and white pavement markings in laboratory and field tests. Lab tests were conducted at the FHWA Turner-Fairbank Highway Research Center amid at the National Institute of Standards & Technology (NIST). In lab tests, temperature and humidity were varied and night and day lighting were simulated to see how the devices performed under different conditions. Field tests were performed on actual pavement markings in North Carolina by the North Carolina DOT. The panel designed the testing program to assess the accuracy, repeatability, and reproducibility of the measurements taken by the six devices under varying environmental conditions. HITEC's side-by-side performance evaluation of retroreflectometers is the first national study of its

kind. The reports contain valuable information for those who will be using or purchasing pavement marking retroreflectometers. As with all HITEC evaluations, the results provide potential users with performance information so they can make informed decisions about which device best suits their needs. The following technical reports can be purchased by calling 800-548-2723 or 703-295-6300, or sending an e-mail to [pubsful@asce.org](mailto:pubsful@asce.org). To download the reports, visit [www.cerf.org/hitec/news/reports.htm](http://www.cerf.org/hitec/news/reports.htm). Vendor contact information is provided for each report.

*Evaluation Findings of the Ecodyn Mobile Pavement Marking Retroreflectometer (#40470);* contact Traffic Safety Systems, Inc. at 800-808-5756 or [tssiusa@msn.com](mailto:tssiusa@msn.com)

*Evaluation Findings of the FRT01 Pavement Marking Retroreflectometer (#40468);* contact Mechatronic at +49 615 117 4038 or [reiner\\_witt@mechatronic.de](mailto:reiner_witt@mechatronic.de)

*Evaluation Findings of the Laserlux Mobile Pavement Marking Retroreflectometer (#40466);* contact Roadware Corporation Inc. at 800-828-2726 or [pbongers@roadware.com](mailto:pbongers@roadware.com)

*Evaluation Findings of the LTL 2000 Pavement Marking Retroreflectometer (#40469);* contact Flint Trading, Inc. at 336-475-6600 or [flintti@compuserve.com](mailto:flintti@compuserve.com)

*Evaluation Findings of the Mirolux Plus 30 Pavement Marking Retroreflectometer (#40465);* contact Mirolux Products, Inc. at 973-779-5775 or [Mirolux@attglobal.net](mailto:Mirolux@attglobal.net)

*Evaluation Findings of the MX 30 Pavement Marking Retroreflectometer (#40467);* contact Advanced Retro Technology Inc. at 410-342-2626

For additional information about HITEC or this evaluation, contact Michael Higgins at 202-842-0555 or [mhiggins@cerf.org](mailto:mhiggins@cerf.org).



## New Clients: Companies Submit Their Products for Evaluation

Master Builders has submitted for CERF's evaluation a concrete admixture used in cold weather. The evaluation will be managed by CEITEC, CERF's evaluation program for products and technologies used in public works. CEITEC plans to conduct a group evaluation of these admixtures, which are manufactured by several different companies. For more information about this project, contact Scott Edwards at 202-842-0555, [sedwards@cerf.org](mailto:sedwards@cerf.org), or visit <http://www.cerf.org/ceitec>.

HITEC has an application from Tricon Precast Ltd. to participate in the ongoing earth retaining systems (ERS) group evaluation. At present, 13 companies have submitted applications to evaluate 17 different ERS technologies. Contact Scott Edwards at 202-842-0555, [sedwards@cerf.org](mailto:sedwards@cerf.org), or visit <http://www.cerf.org/hitec/eval/ongoing/ers.htm> for more information.



## Evaluation Updates

Visit the web site for updates on any of these HITEC evaluations.

Bridge Lockup Device: <http://www.cerf.org/hitec/eval/ongoing/lockup.htm>

Channel Bridge Phase II: <http://www.cerf.org/hitec/eval/ongoing/chanbrid.htm>

Composite Column Wrap: <http://www.cerf.org/hitec/eval/ongoing/colwrap.htm>

Con Arch System: <http://www.cerf.org/hitec/eval/ongoing/conarch.htm>

FRP Bridge Decks: <http://www.cerf.org/hitec/eval/ongoing/decks.htm>

FRP Composite Systems for Concrete Structure Repair & Strengthening: <http://www.cerf.org/hitec/eval/ongoing/frp.htm>

Quadricon Modular Bridge System: <http://www.cerf.org/hitec/eval/ongoing/quad.htm>

Seismic Isolation and Energy Dissipator Devices: <http://www.cerf.org/hitec/eval/ongoing/seismic.htm>

SoundPrint®: <http://www.cerf.org/hitec/eval/ongoing/pure.htm>

Sign Retroreflectometers: <http://www.cerf.org/hitec/eval/ongoing/retro.htm>

Graffiti Removal and Protection Systems: <http://www.cerf.org/hitec/eval/ongoing/graffiti.htm>

SNOWFREE™ Heated Pavement System: <http://www.cerf.org/hitec/eval/ongoing/snowfree.htm>

Thermally Modified Sand: <http://www.cerf.org/hitec/eval/ongoing/tms.htm>

Weigh-in-Motion Sensors: <http://www.cerf.org/hitec/eval/ongoing/weighin.htm>

Alternative Materials Dowel Bars for Rigid Pavements: <http://www.cerf.org/hitec/eval/ongoing/dowel.htm>

Dust Control/Soil Stabilization Agents: <http://www.cerf.org/evtec/eval/dustagnt.htm>

Italgrip Pavement System: <http://www.cerf.org/hitec/eval/ongoing/italgrip.htm>

NYCEM Concrete Strength Product: <http://www.cerf.org/hitec/eval/ongoing/nyco.htm>

Earth Retaining Systems: <http://www.cerf.org/hitec/eval/ongoing/ers.htm>

Adaptive Traffic Signal Control: <http://www.cerf.org/hitec/eval/ongoing/atc.htm>

Digital Cameras: <http://www.cerf.org/hitec/eval/ongoing/cameras.htm>

Traffic Sign Retroreflectometers: <http://www.cerf.org/hitec/eval/ongoing/retro.htm>

Stormwater Best Management Practices: <http://www.cerf.org/hitec/eval/ongoing/stormwtr.htm>



## Symposium 2000: Register Now and Save!

We are pleased that Phillipe Cousteau and John Horsley, AASHTO's executive director and Tom Warne, AASHTO's president, are scheduled to speak at CERF's "International Symposium & Innovative Technology Tradeshow 2000: Moving Innovation Into Practice for a Sustainable Future." FHWA is one of the official sponsors of the event, along with the White House Office of Science and Technology Policy and The American Institute of Architects. The symposium and trade show will take place August 14–17 at the Marriott Wardman Park in Washington, D.C. Over 1,500 attendees from 35 countries are expected to be on hand to network with other design and construction professionals and to learn about innovative products that can be used to build and maintain the world's infrastructure. Attendees will come together in several

consensus-building exercises designed to promote collaborations on design and construction projects and innovative technology deployment. Don't miss this opportunity to interact with industry leaders from around the world!

Obtain your registration form at <http://www.cerf.org/about/2000.htm>. A discounted rate is available until April 15, 2000. Special lodging rates are available at the Marriott Wardman Park Hotel; call 202-328-2900 or 800-228-9240 and request a Symposium 2000 room rate. The lodging discount is available through July 19, 2000.

For more information about Symposium 2000, please contact Bill Carr at 202-842-0555 or [2000@cerf.org](mailto:2000@cerf.org).



## Pankow Award: Application Deadline

The deadline for submitting an application for the 2000 CERF Charles Pankow Award is March 31, 2000. This annual award recognizes companies or individuals that move innovative civil engineering ideas into practice.

This year, the Innovative Applications category will recognize the contribution of organizations working collaboratively to demonstrate innovative approaches to design, materials use, or the construction process. Entries for innovative applications in the following categories are encouraged: Materials and Systems; Construction and Equipment; and Information Technology Systems for Design and Project Management.

The Innovative Concept category was designed to stimulate original and creative design concepts with potential for real-world application. This year's category focuses on green sports arena design using energy-efficient and high-performance materials.

The award winners will be announced on August 15, 2000 at the 2000 Global Innovation Awards Dinner, to be held in conjunction with the CERF International Symposium and Innovative Technology Tradeshow 2000 in Washington, D.C. To receive an application or for more information on the CERF Charles Pankow Award competition, please contact Renee Fortune at 202-842-0555, [rfortune@cerf.org](mailto:rfortune@cerf.org), or visit <http://www.cerf.org/about/pankow.htm>.



## Video Offers Pavement Smoothness Tips

From January 2000 *Better Roads* 29

As the most successful race car driver in National Association for Stock Car Auto Racing history, Richard Petty is known as the king of the asphalt oval. Now, as star of a new Federal Highway Administration videotape, *Smoother Pavements: Highways Fit for a King*, he's headlining a campaign to achieve smoother asphalt pavements nationwide.

Developed by FHWA's Western Resource Center in cooperation with the Arizona Department of Transportation, the video describes Arizona DOT's pavement smoothness program. Under the program, the state inserts a smoothness clause into highway contracts, which provides incentive payments for pavements that meet a specified standard of smoothness.

"After several contracts with the smoothness clause had been completed," says Jim Delton of Arizona DOT. "We were able to show contractors that they could obtain significant incentive payments by using the new technologies and equipment available today." Some contractors have earned as much as \$280,000 in incentive payments. "We consider that money well spent because we're getting much better final smoothness levels than we ever achieved in the past," says Delton. And, in an unexpected bonus, some contractors are reducing their up-front bid price with the expectation of earning an incentive later.

Arizona DOT and its contractors have found that the simplest, least expensive way to improve pavement smoothness is to maintain a more continuous, uninterrupted paving process instead of stopping and starting, which can result in bumps in the mat. For example, crews should make sure that the paving machine always has hot mix in front of it so that there is no need to stop and wait for another load. Smoothness can also be improved by making sure that the steel-wheeled rollers are clean, track straight, and stay on the mat. If the roller is not 100% on the mat, it



*Richard Petty, known as the king of the asphalt oval, headlines for smoother asphalt.*

could pick up material on the edge of the roadway and transfer it to the new surface. And, while improving paving operations is key to achieving smoother pavements, the asphalt plant also has an important role in keeping the temperature of the hot mix as consistent as possible and preventing mix segregation.

By introducing the smoothness specification, "we have changed the state of the art," says Delton. "The smoothness specification encourages innovation and quality work from contractors."

The video was originally slated for distribution only in western states, but FHWA's new national focus on improving pavement smoothness means that distribution has broadened to include transportation departments and contractors across the country, as well as such organizations as the National Asphalt Pavement Association.

*For information on pavement smoothness specifications, contact Mark Swanlund at FHWA, 202-366-1554 (fax: 202-366-9981); e-mail: [mark.swanlund@fhwa.dot.gov](mailto:mark.swanlund@fhwa.dot.gov).*



To obtain a copy of the video, contact Kathleen Bergeron at FHWA, 415-744-2613 (fax: 415-744-2620); e-mail: [kathleen.bergeron@fhwa.dot.gov](mailto:kathleen.bergeron@fhwa.dot.gov). A copy of the video can also be borrowed from the Alaska T2 Center. Call 451-5320.

# Sealing and Filling Cracks in Asphalt

From FHWA-RD-99-176 TechBrief Nov. 1999

## Background

Sealing and filling asphalt concrete pavement cracks is a common road maintenance activity. Specialized materials are placed into or above cracks to prevent the intrusion of water and incompressible material into the cracks and to reinforce the adjacent pavement. To address deficiencies in current crack treatment materials, designs, and practices, the Strategic Highway Research Program (SHRP) and the Federal Highway Administration (FHWA) sponsored the most extensive investigation of crack treatment effectiveness ever undertaken. Monitoring and evaluation of these treatments were performed under the Long-Term Pavement Performance (LTPP) program. Between March and August of 1991, four transverse crack seal test sites and one longitudinal crack fill test site were constructed in the United States and Canada. Upon completion, 6,710 meters of cracks were treated with materials selected for evaluation.

## Objectives

The primary objective of the crack treatment experiment was to determine the most effective and economical materials and methods for conducting crack-sealing and crack-filling operations. Secondary objectives included the identification of performance-related material tests and quicker, safer installation practices.

## Key Benefits of This Research

The benefits of this study include service life estimates of crack sealants and fillers in asphalt concrete pavements, more cost-effective maintenance operations, less exposure of highway workers to traffic, and fewer maintenance delays for the traveling public.

## Experiment Design

The test sites were located on highways of moderate traffic volume in four climatic regions. The four crack seal sites were located on the following roadways:

- Interstate 20—Abilene, Texas Dry-nonfreeze region
- State Route 8—Elma, Washington Wet-nonfreeze region

- State Route 254—Wichita, Kansas Dry-freeze region
  - Interstate 35—Des Moines, Iowa Wet-freeze region
- The longitudinal crack fill site was located at Highway 401—Prescott, Ontario: Wet-freeze region.

Crack treatment materials and installation methods are outlined in Table 1.

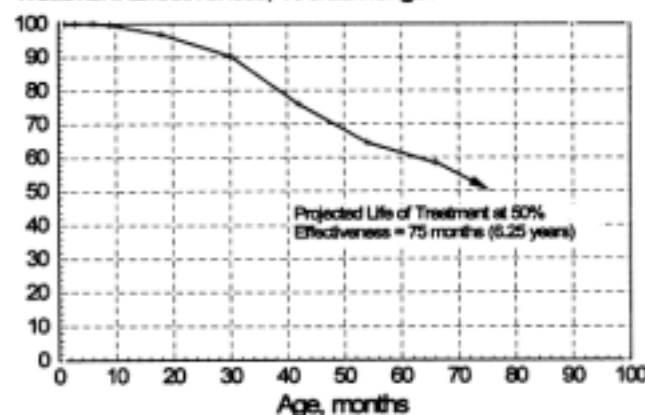
## Evaluations

Ten evaluations were performed during the 6.5-year period. The following evaluation parameters were used:

- Weathering
- Pull-outs
- Overband wear
- Tracking
- Extrusion
- Stone intrusion
- Adhesion loss
- Cohesive loss as a result of tensile/shear forces
- Cohesive loss as a result of bubbling
- Edge deterioration

During each evaluation, detailed examinations and measurements were made at each crack to determine treatment effectiveness. Two sets of laboratory tests were conducted. Initial tests ensured that the materials used in the experiment met the specifications maintained by the manufacturer. Supplemental performance tests were intended to strengthen correlations between laboratory-determined engineering properties and actual field performance.

**FIGURE 1**  
Treatment Effectiveness, % crack length



## Service Life Comparison

Throughout this study, treatments were subjected to numerous, highly detailed inspections for distresses and failures. For this reason, it was determined that field performance would best be framed in terms of service life, which was defined as the estimated time

for a treatment to reach the 75 percent effectiveness level. In other words, the service life is the time required for 25 percent of the crack length to develop failure. The effectiveness level is simply the failure level subtracted from 100 percent (i.e., 10 percent overall failure equals 90 percent overall effectiveness).

**Table 1: Estimated Service Life in Months of Tested Crack Treatment Material**

Crack Treatment Material	Method <sup>1</sup>	Average Estimated Time (in Months) at Which 75% Effectiveness Level was Reached					AVG
		TX ADT=10K <sup>2</sup>	KS ADT=27K	WA ADT=19K	IA ADT=14K	ON <sup>2</sup> ADT=19K	
Meadows Hi-Spec	A-2				57		57
	A-3	58	43	118	61		70
	B-3	78	59	120	82		85
	C-3		56		88		72
	D-3	48	30	120	39		59
	D-4	44	29	95	42		53
Crafco RS 515	B-3	109		120	112		114
	C-3		80		95		88
	D-3	58	33	118	45		64
Koch 9030	B-3	111		120	106		112
	C-3		68		113		91
	D-3	45	24	120	51		60
Meadows XLM	B-3	86		120	114		107
	C-3		70		112		91
	D-3	48	29	119	59		64
Kapelo BF-AC	D-3	9	6	105	19		35
Dow 890-SL	E-5	54	48	109	72		71
Crafco AR+	B-3		52				52
Koch 9000-S	B-3		56				56
ELF CRS-2P	G-4				6		6
Crafco RS 211	B-3			120			120
	H-4					74	74
	G-1					42	42
AC	G-4					42	42
Crafco AR2	D-4					98	98
	G-4					86	86
Hercules FP+AC	D-4					79	79
Witco CRF	G-4					43	43
Hy-Grade Kold Flo	G-4					35	35
Avg. Service Life		62	46	116	71	62	71

Notes: ADT=average daily traffic. K=1,000.

1. The installation methods used were:

### Configuration

- A. Standard Reservoir-and-Flush
- B. Standard Recessed Band-Aid
- C. Shallow Recessed Band-Aid
- D. Simple Band-Aid
- E. Deep Reservoir-and-Recess
- F. Standard Reservoir-and-Recess
- G. Simple Flush-Fill
- H. Capped

### Preparation Procedure

1. None
2. Wire Brush and Compressed Air
3. Hot Compressed-Air Lance
4. Compressed Air
5. Light Sandblast, Compressed Air, and Backer Rod
6. Compressed Air and Backer Rod
7. Light Sandblast, Compressed Air, and Backer Tape

2. Ontario was the longitudinal crack-fill test site. All others were transverse crack-seal test sites.

3. 2-way ADT, vehicles per day.

Rating	Effectiveness Level (%)
Very good	90–100
Good	80–89
Fair	65–79
Poor	50–64
Very poor (failed)	<50

Most of the distresses observed represented a *reduction* in a treatment's ability to perform its function (i.e., to keep water and incompressible materials out of the crack channel). Examples of these distresses include partial-depth adhesion and cohesion loss and overband wear. Some distresses, such as full-depth pull-outs and full-depth adhesion and cohesion loss, signified a treatment's *failure* to perform its function. These latter distresses were termed failure distresses. The total amount of failure distress observed in a treatment formed the basis for performance comparison.

## Key Findings

- Of 61 treatments, 32 had failed after the final round of evaluations.
- Half of the eight crack-fill treatments performed favorably after the final evaluation period. The other half failed.
- Generally, the test sites with greater amounts of crack movement and traffic showed lower levels of treatment effectiveness than sites with less crack movement and traffic.

- The predominant modes of treatment failure were adhesion loss and cohesion loss.
- The most cost-effective treatments were usually those consisting of rubberized asphalt placed in a standard or shallow-recessed Band-Aid configuration.
- The standard recessed Band-Aid method showed the longest estimated service life, followed very closely by the shallow recessed Band-Aid.

## Recommendations

- For short-term crack-seal performance (between one and three years) in pavements with ordinary working cracks (2.5–5.0 mm of horizontal crack movement) and moderate traffic levels, a standard rubberized asphalt should be placed in a simple Band-Aid configuration.
- For medium-term crack-seal performance (between three and five years) under the above conditions, either a standard rubberized asphalt may be placed in a recessed Band-Aid configuration or a modified rubberized asphalt may be placed in a simple Band-Aid configuration.
- For long-term crack-seal performance (between five and eight years) under the above conditions, a modified rubberized asphalt sealant should be installed in either a standard or shallow recessed Band-Aid configuration.

**Researcher:** This study was performed by ERES Consultants, Inc., 505 West University Avenue, Champaign, IL 3915. Contract No. DTFH-93-C-00051.

**Distribution:** This TechBrief is being distributed according to a standard distribution.

**Availability:** This TechBrief is based on report No. FHWA-RD-99-143, "LTPP Pavement Maintenance Materials: SHRP AC Crack Treatment Experiment, Final Report" A limited number of copies are available from the R&T Report Center, FHWA, 9701 Philadelphia Court, Unit Q, Lanham, MD 20706; telephone: (301) 577-0818; fax: (301) 577-1421. Copies are also available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

**Key Words:** Crack seal, crack fill, working cracks, weathering, pull-outs, overband wear, tracking, extrusion, stone intrusion, adhesion failure, cohesive failure.

**Notice:** This TechBrief is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The TechBrief provides a synopsis of the study's findings. It does not establish policies or regulations, nor does it imply FHWA endorsement of the products mentioned, the conclusions reached, or recommendations made. The U.S. Government assumes no liability for the contents or their use.

- For short-term crack-fill performance (one to three years) in pavements with nonworking cracks (less than 2.5 mm of horizontal crack movement) and low to moderate traffic levels, asphalt cement should be placed in flush-fill configuration.
- For long-term crack-fill performance (between five and eight years) under the above conditions, an asphalt rubber or rubberized asphalt may be placed in either a flush-fill or overband configuration, or a fiberized asphalt may be placed in an overband configuration.
- The importance of quality control in crack sealing and filling operations cannot be overemphasized. Crucial to quality control is an objective, hands-on inspector.

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## Pothole Repair

From FHWA-RD-99-202 TechBrief Nov. 1999

Pothole repair in asphalt concrete pavements is one of the most commonly performed highway maintenance operations. To better understand the performance and cost-effectiveness of various cold-mix materials and procedures for repairing potholes in asphalt concrete-surfaced pavements, the Strategic Highway Research Program (SHRP) undertook the most extensive pavement maintenance experiment ever conducted—the SHRP H-106 project. The project was subsequently continued under the Long-Term Pavement Performance (LTPP) program.

### Objective

The primary objective of the pothole experiment was to determine which combinations of materials and patching procedures provide the most cost-effective repair of potholes in asphalt concrete-surfaced pavements.

### Experiment Design

Beginning in March 1991 and ending in February 1992, more than 1,250 cold-mix pothole patches were placed at eight test sites across the United States and

Canada. The sites were located on the following roadways and climatic regions:

- |                                    |                      |
|------------------------------------|----------------------|
| • I-70, Vandalia, Illinois         | Wet-freeze region    |
| State Route 25, Vermont            |                      |
| Route 2, Prescott, Ontario         |                      |
| • I-15, Draper, Utah               | Dry-freeze region    |
| US-395, Alturas, California        |                      |
| US-97, Medoc Point, Oregon         |                      |
| • FM 1570, Greenville, Texas       | Wet-nonfreeze region |
| • Route 518, Las Vegas, New Mexico | Dry-nonfreeze region |

The following patching techniques were used in combination with the various cold mixes:

**Throw-and-Roll**—Material is placed in a hole, which may be filled with water and debris, and then compacted by four to eight passes of the truck tires.

**Edge Seal**—This is the throw-and-roll procedure plus edge sealing, using asphalt tack and sand on the road surface.

**Semipermanent**—Water and debris are removed from a hole, the sides are squared up, and cold-patch material is placed in the hole and compacted by rollers or vibratory compactors.

**Spray Injection**—Water and debris are blown out of a pothole, virgin asphalt and aggregate are sprayed into the pothole, and a layer of aggregate is placed on top of the patch.

A summary of material and procedure combinations used at each test site is provided in Table 1.

## Evaluations

The performance of the various combinations of materials and procedures was observed over time to determine which were the most cost-effective repair types. Monitoring of patch performance was done under SHRP until March 1993 and was then continued under the LTPP program. The last evaluation was made in November 1995.

Evaluations were made at one, three, and six months after the installations were completed, and semiannual inspections were performed for the remainder of the study. Two main types of data were collected during the field performance evaluations. The first type was survival data. This consisted of the number of experimental and control patches still in service along the test site. The second type of data

collected gauged the distresses present in the surviving patches. These distresses included bleeding, cracking, dish, edge disintegration, missing patch, raveling, and shoving.

To identify correlations between material properties and field performance, comparisons were made between laboratory test values and mean field performance values, such as survival rating and average distress ratings.

## Key Findings

- The throw-and-roll technique proved as effective as the semipermanent procedure when the two procedures were compared directly, using similar materials. The semipermanent procedure has higher labor and equipment costs and lower productivity. Thus, the throw-and-roll procedure is more cost-effective in most situations, if quality materials are used.
- Pothole patches are intended to be temporary repairs, but the success rate observed in this project indicated that materials are available that can remain in service for several years. Overall, 56 percent of all patches survived until the last round

**Table 1: Summary of Material/Procedure Combinations**

Material	Procedure	Test Site						
		CA	IL	NM	ON	OR	TX	UT
UPM High-Performance Cold Mix	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
	Edge Seal	✓	✓	✓		✓	✓	✓
	Semipermanent	✓	✓	✓	✓	✓	✓	✓
PennDOT 485	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
PennDOT 486	Throw-and Roll	✓	✓	✓		✓	✓	✓
Local Material	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
HFMS-2 with Styrel 7	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
Perma-Patch	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
QPR 2000	Throw-and Roll	✓	✓	✓	✓	✓	✓	✓
Spray Injection	Spray Injection	✓	✓	✓	✓	✓	✓	✓
QPR 2000	Edge Seal					✓		
	Semipermanent				✓	✓		
PennDOT 485	Edge Seal					✓		
	Semipermanent				✓	✓		
Local Material	Surface Seal		✓					
	Heat and Tack					✓		

of performance monitoring, with 31 percent failures and 13 percent lost as a result of overlays.

- The spray-injection repairs performed as well as the comparable control patches at all sites. This effectiveness, however, depends on the expertise of the operator.
- Of the eight agencies that participated in this experiment, three have switched from the inexpensive cold mixes they previously used to one of the materials provided through this project. One agency also has purchased a spray-injection device to replace its conventional cold-mix patching procedures.

## Recommendations

- Use high-productivity operations in adverse weather. When weather conditions include cold temperatures and precipitation, the prime objective of a patching operation should be to repair potholes as quickly as possible. The throw-and-roll and spray-injection procedures produced high-quality repairs very quickly in all cases. Quality materials should be used with the throw-and-roll procedure, and the spray-injection device should be well maintained and operated by an experienced technician.

- To reduce repatching, use the best materials available. The cost of patching the same potholes over and over because of poor-quality patching material quickly offsets any savings from the purchase of a less expensive cold mix. In most cases, the poorer performance associated with inexpensive cold mixes will result in greater overall costs for patching because of increased costs for labor, equipment, traffic control, and user delay.
- Consider safety and user delay costs in calculating operation costs. When justifying the purchase of a more expensive cold mix, consider the reduced user delay costs that will result when repatching is avoided. Also, consider the improved safety conditions made possible by reduced crew time working alongside.
- Testing should be performed to ensure compatibility of aggregate and binder. Whenever possible, the aggregate and binder to be used to produce a cold-mix material should be tested on a small scale to determine if the two are compatible. This testing is especially necessary when new combinations are being used and there is no record of the patching material's past performance.

**Researcher:** This study was performed by ERES Consultants, Inc., 505 West University Avenue, Champaign, IL 61820-3915. Contract No. DTFH-93-C-00051.

**Distribution:** This TechBrief is being distributed according to a standard distribution.

**Availability:** This TechBrief is based on Report No. FHWA-RD-98-073, Long-Term Monitoring of Pavement Maintenance Materials Test Sites. A limited number of copies are available from the R&T Report Center, HRD-11, FHWA, 9701 Philadelphia Court, Unit Q, Lanham, MD 20706, Telephone: (301) 577-0818, Fax: (301) 577-1421. Copies are also available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

**Key Words:** Asphalt cold mix, asphalt pavement repairs, bituminous materials, patching, pavement maintenance, potholes, asphalt pavement, spray injection.

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### Site of the Month: Software for Design



<http://software.forAEC.com/>

This site contains a fully searchable and comprehensive directory of software for architecture, engineering, and construction. It includes about 3,400

programs and on-line calculators and converters, some of which are available for free for download. The site is part of the CONNET information network for the construction industry.



## Safety and Health Issues

2000

### NAPA Publishes Guidance Document on Material Safety Data Sheets

Lanham, MD — The National Asphalt Pavement Association (NAPA) announces the release of a health and safety publication entitled *Material Safety Data Sheets (MSDS): Guide to the Development, Maintenance, and Use for Hot Mix Asphalt Producers*. This document was designed by NAPA's Safety Subcommittee to assist Hot Mix Asphalt (HMA) facility owners and operators in meeting the Occupational Safety and Health Administration (OSHA) regulations pertaining to an MSDS. OSHA requires that an employer

have an MSDS in the workplace for each hazardous material that it has on its property, uses, or produces.

*Material Safety Data Sheets (MSDS): Guide to the Development, Maintenance, and Use for Hot Mix Asphalt Producers* (Order number HS-1 3) is available at the list price of \$10.00, or \$7.50 for government agencies and not-for-profit organizations, plus shipping and handling. To order, contact the Publications Coordinator at the NAPA office, toll-free 888-468-6499, fax 301-731-4621, e-mail [Publications@hotmix.org](mailto:Publications@hotmix.org), or order on-line through [www.hotmix.org](http://www.hotmix.org).



### Transportation Partners Designate April 3–7 Work Zone Safety Week

To help reduce fatalities and injuries in highway construction areas, the Federal Highway Administration (FHWA), the American Traffic Safety Services Association (ATSSA), and the American Association of State Highway and Transportation Officials (AASHTO) December 15, 1999 signed an agreement to designate April 3–7 as the National Work Zone Safety Awareness Week.

FHWA Administrator Kenneth R. Wykle, ATSSA Executive Director Roger A. Wentz, and AASHTO President Thomas R. Warne signed the document.

In the past decade more than 8,000 fatalities were reported in work zones. Fatalities in 1998 rose to 772, reversing a three-year decline in work zones fatalities from 1995–1997. Approximately 37,000 people were injured in work zones in 1998.

The goals and objectives of today's memorandum of understanding are as follows:

- Increase public awareness of the need for greater caution and care while driving through work zones to reduce fatalities and injuries in work zones.
- Establish and promote a common set of "safety tips" for motorists.
- Increase public sector, industry, and worker awareness of the value of training and best practices regarding work zone safety.
- Establish a nationwide program for promoting work zone safety.
- Communicate to workers and contractors the effects of motorists' frustration with delays on their driving behavior, and suggest possible actions to alleviate that behavior.
- Engage as partners interested parties involved in work zone safety.

## Verification of Roughness Coefficient, Alaska DOT&PF Research Report 99-08

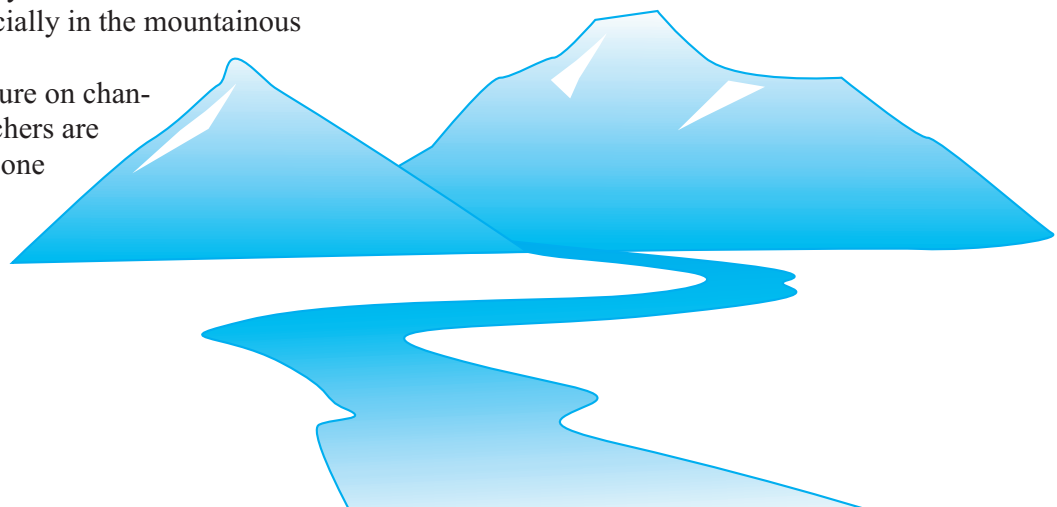
Sounds like the public perception of Alaska: rough country. This project is actually aimed at figuring out flood heights, the volume of water during spring runoff and flood conditions. We know the end result of high velocity and volume, in spades: culverts and bridges wash out, or so much scour happens that eventually culvert and bridge installations have to be restabilized. The idea is to be able to prevent or reduce washouts and scour in the first place. We start with field data based on our conditions, which are admittedly different from much of the rest of the United States.

Developing and improving Alaska's roads means designing bridges or culverts for our many stream crossings. There is very limited hydrologic data to use for hydraulics, which means that designers typically have to estimate streamflow and scour computations. A critical parameter for modeling flood flows is channel roughness. Accurately knowing roughness (friction) coefficients will improve streamflow modeling. We expect to gather enough data to derive better flood heights and stream volumes. Having a better idea of how to predict what the water flow will do, especially during spring runoff and flood conditions, will help designers to design more cost-effective bridges and culverts. For new construction, we will be able to put bridges and culverts in places with reduced scour. Ideally, we'll be able to greatly reduce the number of washouts that occur, especially in the mountainous areas of the state.

There is existing literature on channel roughness, and researchers are finding informally that, if one

follows the national literature recommendations for roughness, Alaskan designers are underestimating the roughness and underestimating flood heights on steeper mountain streams. Roughness coefficients were developed in Lower '48, mostly in the southeastern United States, where there are few large cross sections of steeper streams to observe. Alaska has cascading-flow and boulder-cobble streams, particularly in the southeast and southcentral areas, as well as on the Dalton Highway up to Atigun Pass. To date, Alaskan designers have had to extrapolate roughness coefficients from the Lower '48 data, and experience shows that doing so isn't sufficient to protect our culverts and bridges.

There have been good research opportunities in southeast Alaska this past year, with higher than normal stream flows. This allowed researchers to do some calibration and verification of channel roughness. Initial results tell us that we need higher estimates of roughness coefficients on steep streams, and it may yet provide recommendations on how much higher to estimate. If the research project continues, additional data will be gathered and a final report with recommendations will be developed.



## Pavement Marking Materials, Alaska DOT&PF Research Project 96-06

### Why is Pavement Marking Important?

Perhaps you've noticed that the striping on the road is different from one area to another in Alaska, and even in the Lower '48. In some places, the stripes are nearly invisible during the day and have no reflectivity at night. In some areas, the stripes are bright, bold yellow. And at night, headlights show excellent reflection: the stripes guide you down an otherwise dark road.

Those stripes arrive on the pavement in two ways: as a part of new construction, when a contractor installs the striping; or when maintenance workers have to re-do the marking because it has worn out. Finding the most cost-effective pavement marking materials is a concern of maintenance workers and traffic engineers nationwide. The marking materials are used in three ways: (1) longitudinally, which are the stripes guiding you down the road; (2) transversely, like at crosswalks; and (3) for symbols, such as arrows in the turn lane. In the past, just about the only options were water-based or solvent-based paints. In recent years, however, more striping materials are available, and the costs for them continue to drop.

Durable striping materials are initially more expensive but end up being the desirable option. They remain visible far longer than water-based or solvent-based paints. And the retroreflectivity is considerably higher, both initially and after much wear by traffic. As our population ages, vision decreases, especially at night, which makes night visibility of pavement marking materials more critical. To address this, the Federal Highway Administration is in the process of developing minimum retroreflectivity standards.

### What's Alaska Doing?

Alaska Department of Transportation and Public Facilities is studying which pavement marking materials last the longest. You may have noticed the cross-road stripes on the westbound lanes of the Mitchell Expressway between Lathrop Street and Peger Road in Fairbanks and on the northbound lanes of the Glenn Highway at about mile 28, near Eklutna in Anchorage. The Anchorage test section was installed in September



1998 and the Fairbanks section in August of 1999. DOT&PF expected the project to be finished by the fall of 1999; however, monitoring continues on both the Fairbanks and Anchorage test decks. The stripes haven't worn away enough to determine the life of the tested materials.

### What We've Learned So Far

- Durable pavement markings are superior to paint.
- Initial retroreflectivity of durable pavement markings is two to three times that of paint.
- Durable pavement markings are cost effective for high volume roads.
- Durable pavement markings are probably not cost-effective for low-volume roads paved with bituminous surface treatments (BST) or high float surfacing, because the paint may well out-last the road surface.
- The jury is still out on how to handle medium-to-low-volume roads paved with hot asphalt pavement.

### Recommendations to Date

In general, use solvent or water-based paints for longitudinal, transverse, and symbol markers on:

- BSTs and high float surfaces
- pavements on unstable foundations, which are patched regularly

In general, use durable pavement marking materials on rural pavements on the National Highway System, on stable foundations, which have an anticipated life of more than three years.

For full preliminary recommendations, see the following table.

*For more information, call Jim Bennett, DOT&PF, Research and Technology Transfer, 907-451-5322 or Billy Connor, DOT&PF, Research and Technology Transfer, 907-451-5479*

**Materials Installed on Test Decks**

Stimsonite Preformed Thermoplastic  
Columbia Spray  
Paint  
Rite-Mark Spray Methyl Methacrylate (MMA)  
Rite-Mark Cold Extruded MMA  
Flint Preformed Thermoplastic – PREMARK  
Dura Stripe Spray MMA  
Dura Stripe Cold Extruded MMA  
Flint Preformed Thermoplastic – Experimental

**Preliminary Pavement Marking Materials Recommendations  
Spring 2000**

<b>Pavement Marking Application Matrix</b>						
<b>Surface</b>	<b>Type of Marking</b>	<b>Area</b>	<b>Expected Pvmnt Life</b>	<b>Average Annual Daily Traffic</b>		
				<b>&lt;=2,000</b>	<b>2,000&lt;ADT&lt;10,000</b>	<b>&gt;=10,000</b>
Stable Pavements	Longitudinal	Urban	> 1 year	Paint	Methyl	Methyl
			<= 1 year	Paint	Paint	Paint
		Rural	> 3 years	Paint	Methyl or Paint	Methyl
			<= 3 years	Paint	Paint	Paint
	Transverse & Symbols	All	> 1 year	Durable	Durable	Durable
			<= 1 year	Paint	Paint	Paint
BST, High Float, and pavements that need regular patching	All	All	All	Paint	Paint	Paint

## American Water Resources Assn. Conference

The American Water Resources Association's spring specialty conference on Water Resources in Extreme Environments has presentations for agency and private sector personnel who build or maintain roads. The conference is May 1–3 at the Sheraton Anchorage Hotel. Besides several days of conference sessions, AWRA is conducting two post-conference short courses. One is winter streamflow measurement; the other, fish passage: analyzing road culverts for the passage of anadromous and resident fish species has particular application for those who design roadway culverts. Registration deadline for these courses is April 7.

Nearly all conference sessions have some application for workers in transportation. Check out the poster sessions and the presentations during the day. Examples include: river runoff formation in permafrost zones; glacier-dammed lakes in Alaska; hydrologic processes in a watershed underlain by discontinuous permafrost; several sessions on the effects of snowmelt; a search for effective cold climate best management practices; chloride in street snow melt in Anchorage; stream channel hydraulics; and forecasting streamflow rates. And these are just the highlights.

*For more information: Doug Kane, 907-474-7808, e-mail [ffdtk@uaaf.edu](mailto:ffdtk@uaaf.edu); or Roger Allely, 907-269-8644, e-mail [roger\\_ally@dnr.state.ak.us](mailto:roger_ally@dnr.state.ak.us)*

Training (www.dot.state.ak.us, click on "training opportunities")

Date	Event	Sponsor/Contact	Location
April 9–12	2000 North American Snow Conference APWA	Diana Forbes, 816-472-6100, ext. 3520 dforbes@apwa.net www.pubworks.org/	Acme, MI Grand Traverse
April 11–13	Traffic Signal Workshop Northwestern University	Simon Howell, (907) 451-5482	Anchorage, Egan Center
April 12–14	NHI 13132, Hot Mix Asphalt Construction	Sharon McLeod-Everette, (907) 451-5323	Fairbanks, Westmark Hotel
April 17	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Anchorage Municipality of Anch. Public Works Conf. Rm
April 18	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Palmer Cottonwood Cr. Conf. Rm
April 19	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Glennallen TBA
April 21	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Fairbanks TBA
April 25	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Whitehorse Westmark Whitehorse
April 28	NHI 38060, Work Zone Traffic Control for Maintenance Operations on Rural Highways	Sharon McLeod-Everette, (907) 451-5323	Soldotna TBA
April 24–28	ATSSA Traffic Control Technician (1 day) Traffic Control Supervisor (2 days) Flagger Instructor Training (2 days)	ATSSA, 1-877-642-4637 or www.atssa.com	Anchorage, Operating Eng./ Employers Training Trust Upstairs Conf. Rm
April 30–May 4	American Water Resources Association 2000 Spring Specialty Conference	Doug Kane, (907) 474-7808 awra.org/meetings/alaska2000/	Anchorage Sheraton Hotel
May 1–10	Asphalt Laydown & Compaction Workshop May 1–3 Classroom & demo May 4–5 & 8–10 Asphalt laydown	Sharon McLeod-Everette, (907) 451-5323 or Gerry Andrews (907) 746-3117	Palmer Operating Eng./ Employers Trng. Trust School
May 18–19	NHI 35005, Highway Program Financing	Sharon McLeod-Everette, (907) 451-5323	Anchorage, Sheraton Hotel
May 22–23	NHI 35005, Highway Program Financing	Sharon McLeod-Everette, (907) 451-5323	Juneau, Centennial Hall
May 25–26	NHI 35005, Highway Program Financing	Sharon McLeod-Everette, (907) 451-5323	Fairbanks, Westmark Hotel
June 19–22	Systematic Development of Informed Consent Plus, Hans & Annmarie Bleiker	Sharon McLeod-Everette, (907) 451-5323	Fairbanks, Westmark Hotel
Grader Operator Training is coming during May–August, but is not yet scheduled; contact Sharon McLeod-Everette, (907) 451-5323			

## Meetings Around Alaska

Society	Chapter	Meeting Days	Location
ASCE	Anchorage	Monthly, 3rd Tues., noon	Northern Lights Inn
	Fairbanks	Monthly, 3rd Wed., noon	Captain Bartlett Inn
	Juneau	Monthly, 2nd Wed., noon*	Westmark Hotel * except June–Aug.
ASPE	Anchorage	Monthly, 2nd Thurs., noon	West Coast International Inn
	Fairbanks	Monthly, 1st Fri., noon	Captain Bartlett Inn
	Juneau	Monthly, 2nd Wed., noon*	Westmark Hotel * except June–Aug.
ASPLS	Anchorage	Monthly, 3rd Tues., noon	Executive Cafeteria, Federal Building
	Fairbanks	Monthly, 4th Fri., noon	Ethel's Sunset Inn
	Mat-Su Valley	Monthly, last Wed., noon	Windbreak Cafe; George Strother, 745-9810
ITE	Anchorage	Monthly, 4th Thurs., noon**	Sourdough Mining Co. ** except July & Dec.
IRWA	Sourdoughs Ch. 49	Monthly, 3rd Tues., noon**	West Coast International Inn
	Arctic Trails Ch. 71	Monthly, 2nd Thurs., noon**	Oriental House
	Totem Ch. 59	Monthly, 1st Wed., noon	Mike's Place, Douglas ** except July & Dec.
ICBO	Northern Chapter	Monthly, 1st Wed., noon brown bag lunch	Rm. 531 Duckering Bldg, Univ. of AK Fairbanks Larry Hinzman, 474-7331
PE in Government	Anchorage	Monthly, last Fri., 7 a.m.	Elmer's Restaurant

## Did You Know? Training, Reports, and Library



You can now register for training on the Department of Transportation and Public Facilities' (DOT&PF) web site. Go to [www.state.ak.us](http://www.state.ak.us), find "Training Opportunities," click on that and follow the directions. Or go directly to [www.dot.state.ak.us/external/state\\_wide/t2/index.html](http://www.dot.state.ak.us/external/state_wide/t2/index.html). This web site has all the training offered through the department's Local Technical Assistance Program (LTAP) Technology Transfer (T2) section and through the National Highway Institute (NHI) training program.

Nearly all of DOT&PF's research reports are available through the same web site. Go to

[www.state.ak.us](http://www.state.ak.us), find Statewide Design & Engineering Services, click on that, find Research and Tech Transfer, then Library, and follow the directions.

You can also find current research projects on the same site; instead of clicking on Library, go to Research.

The DOT&PF web site has lots to offer. Investigate it any time.



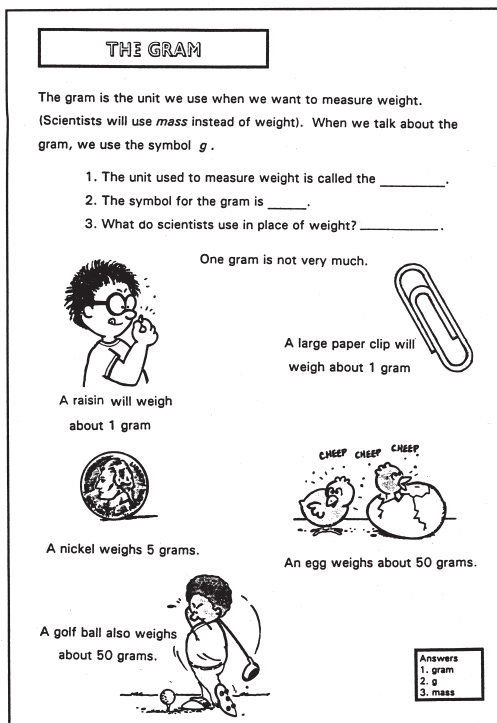
## DOT Traffic Safety Administration Begins Last Phase of Changing Standards to Metric

In regulations issued November 1999, the Department of Transportation (DOT) Traffic Safety Administration announced that it is entering the third (and last) phase of its "amending selected Federal motor vehicle safety standards by converting English measurements in those standards to metric measurements. This rulemaking is the third and final in a series that the agency will undertake to implement the Federal policy that the metric system is the preferred system of weights and measures for U.S. trade and commerce."

**The 30-page 1999 edition of the USMA Guide to the Use of the Metric System (SI Version) helps you learn how to use the metric units and also provides the rules for correct SI usage.**

**To obtain it, send \$17 to:  
USMA, 10245 Andasol Aye, Northridge  
CA 91325**

## Easy SI Training Provided By Metric FUNdamentals Book



Artwork by Bill Rehlander.

*Metric FUNdamentals* is a cleverly formatted 74-page book for teaching elementary-school youngsters to use the metric system. It also would be helpful for older beginners because it provides the basics on the metric system's meter, liter, and gram in an easy-to-understand manner. Written by Paul Ross Wallach, the author of a number of educational books, this book is profusely illustrated, using cartoon-type characters who show what the interestingly written text describes. The illustrations shown here give a sample of how the book teaches SI. Consisting of 74 shrink-wrapped, unbound pages to allow easy photocopying, the book is set up so purchasers of the book can make as many copies as desired. It is available to USMA members for \$18 and to nonmembers for \$25, from Ross Publishers, 1624 Balboa Way, Burlingame CA 94010.



### Double Fines in Work Zones

Jack Hammer, the animated character in FHWA's campaign to increase work zone safety, will be reminding all Alaskans that there will still be double fines for traffic violations in work zones.

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